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EDITORIAL

Only a few exceptional students enter Medicine with an exact idea of what they wish to gain from the course and what they hope to do after graduation. Many students have a vague impression that Medicine is a good course to take and leave the rest to the Faculty. Such is the fascination of the study of medicine, that most of these later become very industrious students and, in their final year, have definite plans concerning their studies and future careers. However, before becoming imbued with the enthusiasm for study, which is a part of medical training, these students drift along, doing poor work, because they see no immediate reason for applying themselves. For these students the incentive which is lacking can be supplied by the pursuit of two distinctions, both of which can be atained by the end of the fourth year. These are the primary "Fellowship" examination and membership in the Alpha Omega Alpha Honor Medical Society.

The first College of Surgeons was founded in France in the year 1279. Although this college has long since ceased to exist many of the organizations which were modelled on it are playing an active part in medical affairs today. Of the Colleges which are well known in Canada the Royal College of Surgeons of Edinburgh is the oldest, having been established in 1505.

The Royal Colleges of London soon followed, that of the Physicians in 1518 and that of the Surgeons in 1540. The most recent addition to this ancient line is the Royal College of Physicians and Surgeons of Canada which received the Royal Charter on June 14th, 1929. In spite of its youth this College is already well regarded because of the exceptional ability of the charter members and the high standards which have been maintained in the examinations for the Fellowship. It seems very probable that, within the next ten years, the Fellowship will become a necessary qualification for appointment to the staffs of the better hospitals in Canada. It is therefore essential that every student who has the ability to do so should try the examinations. These examinations are held in two parts. The primary examinations which are held annually, in October, cover Anatomy and Physiology and allied subjects. Since he knows more about these subjects at the end of his third year than he is ever likely to know again, the good student should make the Primary Fellowship Examination a goal to be achieved at that time.

The Alpha Omega Alpha, Honor Medical Society was founded in 1902; the Toronto chapter being inaugurated in 1906. Its aims are the promotion of scholarship and research in medical schools, the encouragement of a high standard of character and conduct among medical students and graduates, and the recognition of exceptional attainment in medical science or practice. The society holds scientific meetings throughout the year at which papers are presented by the undergraduate members. These meetings are also attended by many distinguished graduates and the student has an exceptional opportunity for meeting the leaders of the profession. About 10 students from each class are invited to join the society, five in the fifth year and five in the sixth. The number invited each year is not fixed and only those who are deemed worthy are asked to join. Exceptional scholarship throughout the whole course is an essential for membership, but other qualifications are also considered. Each year there are a few students who would gain this much coveted membership if they had not been content with a low standard of work in their earlier years. Since the society is very active throughout the United States as well as in Canada, membership in it is by no means an unimportant distinction. The small gold key, emblematic of membership in the Society, is a reward worth striving for.

OPEN MEETING OF THE MEDICAL SOCIETY

The first open meeting of the Medical Society, for this year, was held on November 19th. Professor C. H. Best, head of the Department of Physiology, addressed the meeting on "The Russian Physiological Congress'. Dr. Best and several other members of the staff of the University attended the Fifteenth International Physiological Congress which was held in Leningrad and Moscow in August of this year. He outlined the trip from London to Leningrad on a Soviet steamer, the stay in the U.S.S.R. and the return journey through the Scandinavian countries. The lecture was profusely illustrated with lantern slides. The lavish hospitality which the Soviet Government showered upon the delegates was graphically described. Many interesting sidelights upon Russian character and upon the operation of a Communistic social order were given. Brief reference was made to some of the scientific aspects of the trip, including the new protamine insulin which has been developed in Copenhagen.

It was very pleasing to see such a large and enthusiastic audience turn out to hear one of our own staff. Everyone present enjoyed the meeting and we can only hope that subsequent meetings will be equally successful.

THE OBJECTIVE AND SUBJECTIVE EFFECTS OF SEX-HORMONE THERAPY

By MELVILLE C. WATSON, M.B.
Department of Obstetrics and Gynaecology

The subjective and objective effects credited to the action of sex hormones in an individual case frequently appear to be miraculous. Like most miracles, those which appear to follow surgical or medicinal treatment of any kind, can usually be explained on a scientific basis. It was for this reason that over three years ago, we decided to make observations on the effects of the administration of the sex-hormones to patients suffering from abnormal function of the generative organs. These observations began in the gynaecological clinics of the Toronto General Hospital under the direction of Professor W. B. Hendry, and are being continued under the direction of Professor W. A. Scott, who has succeeded Professor Hendry as head of the Department of Obstetrics and Gynaecology. In addition to observing the effects of the administration of the sex-hormones, we are attempting a more accurate diagnosis of the endocrine states associated with altered function of the reproductive organs. The recent discovery of the hormones, and the recovery of many of them in an active, and others in a chemically pure form, has greatly assisted with the diagnosis in cases suffering from this type of endocrinal disturbance.

The effects of sex-hormone therapy in the human have not been as pronounced as those observed after administration of the same substances to the rodent, even when proportionately larger doses are used. At the same time it is generally agreed that the development and function of the reproductive organs in the human, is accomplished and maintained in part by the sex hormones with which we have now become familiar.

Gonadotropin

The anterior-pituitary is recognized as the governor of ovarian function through the action of the ovarian-stimulating hormone, gonadotropin, which it produces. Gonadotropin possesses a dual activity (a) follicle stimulating, and (b) luteinizing. The two factors have not been separated chemically, but the majority of investigators maintain that the gonadotropic substance is capable of these two definite actions. The ovary becomes quiescent and undergoes an atrophic degeneration unless maintained and activated by the anterior pituitary. The function of the ovary is apparently altered by hypo or hyper-secretion of either of the gonadotropic factors. Gonadotropin will undoubtedly be the most effective supplemental hormone in the treatment of amenorrhoea due to pituitary failure, if it proves to be active in the human, because theoretically it should be capable of producing the normal cyclic response in the ovary i.e. development of a normal follicle containing a healthy ovum, release of the ovum, and development of the lutein body. Results to date, of our investigations with this substance in carefully selected cases, justify our entertaining some hope that it does stimulate the ovary.

Anterior-Pituitary-Like Substance

As the name suggests, anterior-pituitary-like substance (A.P.L.), produces effects in the ovaries when administered to test animals, similar to those attributed to gonadotropin. It has been found, however, that A.P.L. does not produce the pronounced foll-

icle stimulating and luteinizing effect in previously hypophysectomized animals. Consequently A.P.L. is now credited with having a synergistic action with the true gonadotropic substance, causing the normal effect of the latter to be greatly augmented. Anterior-pituitary-like substance has not been recovered in a crystalline state, it is extracted from the placenta of the human, and is recovered from the urine during pregnancy, soon after the fertilized ovum becomes embedded. It is the substance in the urine of pregnancy (human) which is responsible for the ovarian response in the test animal that constitutes the A.Z. test for pregnancy. No marked effect has been observed on the human ovary following administration of A.P.L. Despite the apparent negative effect on the ovary, administration of A.P.L. is credited with the control of functional bleeding during the reproductive period in the human.

Oestrin

The ovarian follicle apparently produces an active principle necessary for the cyclic periodicity of menstruation. Many of the growth changes characteristic of the human female are attributed to this substance. "Oestrin" is used as a covering term to include all the compounds showing oestrogenic activity, which are enumerated below:

(1) Oestrone or ketohydroxyoestrin (theelin, oestroform)
(2) Oestriol or trihydroxyoestrin (theelol)
(3) Oestradiol or dihydroestrin
(4) Benzoate of oestradiol (oestroform "B," Progynon "B")
(5) Emmenin—a placental extract containing oestriol.

Emmenin is extracted from human placenta; oestrone, oestriol, the parent active principles from which the other compounds are derived, are recovered from pregnancy urine (human, mare) for commercial supply. It is thought that the placenta is responsible for the production of the large amounts of oestrin excreted during pregnancy.

With the exception of emmenin, all these substances exhibit their optimum activity when injected hypodermically. They are then absorbed and transported by the blood stream to the tissues of the reproductice organs. It is thought that oestrone and oestriol are inactivated to some extent by entering into other compounds in the liver or in the blood itself. The benzoate of oestradiol was introduced because it prevents the active substance from entering into any further chemical combination. The fact that emmenin is active when taken by the oral route appears to indicate that the active principle in this case is in such a combination that it escapes alteration not only by the blood or liver, but also by the digestive fluids in the alimentary tract.

Increase in the size of the uterus with an accompanying development of the endometrium similar to that occuring in the first stages of the menstrual cycle, have been observed following large doses of the crystalline substances. (Werner, Collier, Kaufmann, Loesser, etc.) We have observed and others have reported, epithelialization of previously desquamated areas in vaginal and vestibular epithelium following injections of the benzoate of oestradiol. In one of our cases a chronic ulceration about the vestibule healed within seventy-two hours after local injection of two-hundred thousand units of oestradiol. Uterine hemorrhage can be induced, and when it occurs it usually follows three or four days after the injection of large doses. Hypertrophy of the breast, noted by increase in size and erection of the nipple, has frequently been observed as a temporary phenomenon in the course of treatment. In many cases where observations and treatments have been continued over a period of months we have been intrigued by changes in the demeanour and mental attitude of the patients. This applies particularly in young girls where relief from dysmenorrhoea has

been marked; in castrates and in other cases suffering with severe menopausal disturbances, from which relief has been claimed. Such results cannot be recorded or described satisfactorily, and it should not be hastily claimed that they are due to the effect of oestrin.

Subjective results from this form of therapy are extremely difficult to interpret. The symptoms: pain, pruritis, headache, dizziness, etc., are some of those from which patients frequently claim complete relief. These symptoms are sometimes relieved by improvement in economic conditions and changes in the patient's interests in life. There is no doubt that many of these patients are improved by the mere fact that we require them to visit the clinic more frequently than would be otherwise necessary. They become interested and occupied mentally, and are not so conscious of the stimuli which give rise to their symptoms.

Progestin

Progestin, the active principle of corpus luteum secretion has recently been discovered in a chemically pure form. In the normal menstrual cycle, this substance is responsible for the increase in development and secretory activity of the endometrial glands during the final or progestational phase. A similar development has been observed in the human castrate following administration of progestin in cases which had previously received large doses of oestrin. Progestin appears to be normally concerned with the nidation of the fertilized ovum during the first weeks of pergnancy. Our experience with the therapeutic use of progestin has been limited. We are conserving our present supply for observations of its effect on the endometrium in selected cases. Reynolds, in a recent publication states that it has been definitely established that pure crystalline progestin not only induces full endometrial growth, but inhibition of uterine activity as well.

The scope of this paper is limited because another communication entitled "The sex-hormones and their value as therapeutical agents in obstetrics and gynaecology" is in press. Our observations on the diagnosis and treatment of amenorrhoea are not complete, and therefore reserved for a more detailed report in the near future.

It is a pleasure to acknowledge the direction and encouragement received from Professor W. B. Hendry, and Professor W. A. Scott, the invaluable assistance of Professor G. F. Marrian of the department of biochemistry, who has been a constant guide with the chemical problems and has supplied us with quantities of oestrone, oestriol and progestin, and also the co-operation of Professor J. B. Collip in arranging immediate supply of gonadotropin from his department.

We are exceedingly grateful to the Banting Research Foundation for financial assistance with the investigation of the problem of amenorrhoea which is still in progress; to the Connaught Laboratories for assaying and ampuling a supply of progestin; also to Ayerst, McKenna, and Harrison Ltd., for liberally supplying unlimited quantities of emmenin, and A.P.L. free of charge and more recently the anterior-hypophyseal extracts, at cost.

THE TRUE ECONOMY OF DEXTRI-MALTOSE

It is interesting to note that a fair average of the length of time an infant receives Dextri-Maltose is five months: that these five months are the most critical of the baby's life: that the difference in cost to the mother between Dextri-Maltose and the very cheapest carbohydrate at most is only $6 for this entire period—a few cents a day: that, in the end, it costs the mother less to employ regular medical attendance for her baby than to attempt to do her own feeding, which in numerous cases leads to a seriously sick baby eventually requiring the most costly medical attendance.

PAEDIATRICS IN EUROPE

NELLES SILVERTHORNE, M.B.
From the Department of Paediatrics, University of Toronto.

It is my purpose to discuss very briefly the more outstanding children's clinics in Europe which I had the opportunity of observing during a five months' visit this summer. The practice of Paediatrics is not as limited a specialty in Europe generally as on the American continent, yet there are some very excellent clinics.

Most of May, June and part of September were spent in London at the Childrens' Hospital, Great Ormond Street, and at three large fever hospitals. The Children's Hospital is a very old institution with a large in-patient and out-patient clinic. On the medical side, the Hospital is staffed with four senior physicians, several out-patient physicians, a pathologist and bacteriologist, a resident medical officer for in-patients as well as one for out-patients. A group of resident interns are allocated to the various medical wards. One finds in such a centre great numbers of the common clinical entities as well as a fair proportion of rare types of disease, such as cases of glycogen disease, scleroderma, acrodynia, patients which simulate Morquio's syndrome and a variety of interesting blood diseases. The less prevalent types of renal rickets, with occasional calcium deposits in the kidney calyces are seen. Lymphatic leukaemias with the typical bone changes as shown by X-rays are occasionally admitted. An outstanding feature about rheumatic fever in England is the large number of cases during childhood with the typical nodules found over bony prominences. This type of patient comprises a fair proportion of admissions to Great Ormond Street. Of the scientific investigations at Great Ormond Street, possibly the work on the demonstration of "elementary bodies" from pericardial fluid, from cases of subacute smouldering rheumatism, is the most interesting advance in this subject. Investigations with the "urea clearance" test in nephritis and with oestrin in the treatment of vulvovaginitis in children have been carried out. In London, there are facilities in other hospitals such as the British Post Graduate Medical School and many of the larger general hospitals for the teaching and study of children's diseases.

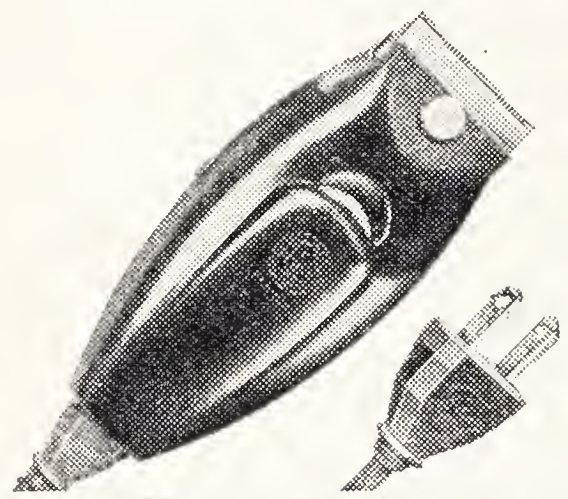
The three fever hospitals visited were exceptionally well staffed and equipped. The incidence of cross infection in these institutions is admirably controlled, one of the more important measures being the 12 foot bed spacing which is rigidly adhered to. The work in these institutions is of the highest quality and the methods of treating infectious diseases are, on the whole, of the same high order. There are many patients with diphtheria and scarlet fever. In the former disease, large doses of antitoxin are used in treatment. Electro - cardiographic studies of the myocardial complications form an important part of their observations in this disease. At one fever hospital, investigations on the isolation of H. pertussis by the cough plate method are in progress. Cerebrospinal fever is treated in much the same manner as in America, the general attitude is taken that although the use of antimeningococcic serum is of value, there are no spectacular results in reducing to lower levels present mortality rates by the use of any polyvalent serum. In some places in the British Isles they have used Ferry's antitoxin in the treatment of meningococcal infections with no better results than with the usual 4 type antimeningococcic serum.

After two very profitable months in London, the Children's Hospital at Birmingham was visited, where Professor Leonard Parsons is in charge. Dr. Parsons' clinic is one of the finest and most active in England. Each day is pretty well taken up with rounds followed by X-ray and post mortem studies. At this clinic for many years investigations on blood dyscrasias in children have been in progress. One sees types of blood diseases and internal diseases in the older child, of interesting and bizarre nature. Many cases of acute haemolytic jaundice are admitted. This disease is more prevalent at certain seasons than at others, so much so, that it is held to be due to an infection. A variety of very rare entities in childhood were seen at the hospital, such as a case of premature senility and children suffering with various lipoid disturbances, for example, the Schüller-Christian syndrome with the classical "moth-eaten" X-ray appearance of skull, exophthalmos and diabetes insipidus. Post mortem specimens from these various lipoid diseases and also from conditions that clinically simulate them are available for study. Children with coeliac disease are also in the wards and one need but refer to the complete and excellent work of Professor Parsons on this disease. In their laboratories, studies on rickets, scurvy, blood diseases and coeliac disease form the major part of their investigations. At the hospital are departments excellently equipped for the correction of squint and speech defects.

On the continent, especially in Holland, Denmark and Sweden, some excelent hospitals are to be found. From the viewpoint of the paediatrician, some of the best clinics in Europe are situated in these northern countries. The three centres which most favourably impressed me were the new and modern children's hospital at the huge polyclinic at the University of Leiden in Holland, under the directorship of Professor Gorter, the children's and epidemic hospitals in Copenhagen, Denmark, under Professor Monrad and Professor Bie and the Children's Hospital in Gothenburg in Sweden where Professor Wallgren is the chief physician. These centres are well recognized as excellent paediatric schools and places where a very thorough type of scientific research is in progress. Firstly, allow me to refer to the clinic in Leiden where Professor Gorter is full-time professor of paediatrics. The Children's Hospital is a separate unit on the grounds of the large polyclinic. It is a very modern institution, and excellently equipped as a university teaching hospital. The wards are constructed in the form of glass cubicles with individual wash basins; gowns and masks are worn by all physicians, nurses and attendants. Each ward is equipped with a balcony and patients may be conventiently moved out of doors for fresh air and sunshine. One floor is reserved for all types of infections and the other floor for nutritional, metabolic and all non-infectious diseases. The milk department is completely equipped; all feeding utensils are sterilized and all milk is pasteurized in the hospital. The out-patient department is on the ground floor at the front of the building with excellent examination rooms, laboratories and facilities for the examination of X-ray films. At one end of the ground floor, next to the out-patients' department, is a large semi-circular theatre clinic where the professor presents clinical material. Each case is very thoroughly analysed, the professor demonstrating methods of physical examination, discussing differential diagnosis and treatment. On one floor is the reasearch department and here, under Dr. Gorter's direction, full time workers are carrying out investigations. On the same floor, near the laboratories, is the library. Particularly interesting is the ingenious apparatus designed by Dr. Gorter for the measurement of surface tension. He has been investigating the changes in surface tension of various body

fluids in health and disease. One is impressed with the excellent combination of clinical and research medicine. On rounds Professor Gorter and his staff make the study of disease in children stimulating and this is greatly enhanced by the numbers of interesting cases. Many conditions that I had not seen in any clinic were to be found in the wards of the hospital at Leiden. Among the different diseases seen at this clinic were cases of arsenic poisoning caused from the process of stuffing birds, actinomycosis of lungs, subcutaneous fat necrosis and infantile hypoglycaemia with convulsions occurring as a familial entity. One very rare condition was seen in a girl of three years of age who since birth has developed periodic attacks of fever with inflammatory tumors involving skin and subcutaneous tissues. After the fever subsides, the lesions disappear. Complete laboratory investigations failed to reveal any etiological agent.

The next centre of medical interest is Copenhagen. I had the opportunity of visiting the Children's Hospital where Professor Hirschsprung was, at one time, the chief physician. There are many children's clinics in Copenhagen and with the time at my disposal I was able to visit Professor Monrad's clinic and the Blegdams hospital under the direction of Professor Bie. The latter place is a large epidemic hospital and is not strictly comparable to the fever hospitals in England or our isolation hospitals in America. The epidemic hospital admits every conceivable form of infection, including all the communicable diseases as well as a variety of rare diseases for diagnosis.



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This institution has a 500-600 bed capacity and it usually takes one week to make complete rounds. Dr. Bang, assistant to Professor Bie during the latter's absence, demonstrated many peculiar diseases that were in the hospital. There were cases of infectious mononucleosis and agranulocytosis; the latter, they are convinced, is due to the constant use of amidopyridine. They are using at this hospital a new form of respirator made in Sweden which in many respects is an improvement on the Drinker apparatus. Among other institutions visited were the State Serum Institute and the new diabetic hospital; they are both excellent places and the latter, I believe, is one of the finest units of its kind in existence. After Copenhagen the clinic of Professor Wallgren in Gothenburg, Sweden, was visited. At the Children's Hospital in Gothenburg, Dr. Wallgren has worked for years on many aspects of tuberculosis. He has studied the onset of the primary infection in infants and has followed most of these children to adolescence by repeated physical examination including use of fluoroscope, X-rays and sedimentation tests. Professor Wallgren has accumulated a great amount of information regarding this disease from a prophylactic as well as therapeutic standpoint. Some eight or nine miles from the city there is a convalescent home which is owned by the hospital. This country hospital is situated on an island and is equipped to treat his convalescent cases. Dr. Wallgren makes rounds daily with four senior full-time physicians and in this way most of the clinical material is thoroughly investigated. To a large extent the Scandinavian paediatricians are using the patch test as an aid in the diagnosis of tuberculosis. Many clinicians have made use of B.C.G. vaccination in the prevention of the disease. Dr. Wallgren is of the opinion that B. C. G. vaccination has definitely reduced the incidence of tuberculosis. I would like to emphasize that in Glasgow there is a very fine children's hospital where Dr. Stanley Graham is a senior physician.

I have attempted in this brief article to give the reader an impression of the more outstanding clinics on the continent and in the British Isles. Space does not permit of a detailed description of the excellent post-graduate course that may be taken in this way. Most of one's time is very well occupied and if those wishing to take such a course will choose the main paediatric centres I have mentioned, it is my opinion that a great deal can be accomplished in five or six months, provided you have first spent a few years in paediatric Post-Graduate work.

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SOME ASPECTS OF THE PHYSIOLOGY OF THE URINARY BLADDER

By M. D. LEWIS, B.Sc. (Med.) '36.

The urinary bladder is essentially a muscular organ, the function of which is to store and to periodically discharge the urine. For our purposes it may be considered as being made up of two functional muscular units, the detrusor and the internal sphincter, both of smooth muscle. In addition, in the urethra there is a concentration of striated muscle which forms the external sphincter or compressor urethrae.

The Nerves of the Bladder.

The following description of the nerves of the bladder follows fairly closely that given by Learmonth (1) of the Mayo Clinic. It is based entirely on observations on the human.

The nerves which reach the urinary bladder belong to three systems, the sympathetic, the parasympathetic, and the somatic. Each of these carries afferent as well as efferent impulses.

1. The *sympathetic* fibres for all the pelvic viscera including the bladder, are collected together in front of the bodies of the 4th and 5th lumbar vertebrae to form the so-called presacral nerve. Presacral seems a somewhat peculiar name for this structure, as it is largely prelumbar rather than presacral, and often a plexus rather than a nerve (2). It is formed by branches from the paravertebral sympathetic chain together with communications from the coeliac and other sympathetic nerve plexuses in the abdomen. At the level of the promontory of the sacrum, it divides into two hypogastric nerves. Many anatomy (3) and physiology (4) text books say that these two hypogastric nerves are derived from an inferior mesenteric ganglion, but Learmonth (1) states that in the human the existence of this ganglion is hypothetical, and that it could be identified in only one of 14 cases at operation. The hypogastric nerves end in the corresponding hypogastric or pelvic ganglion (also called the hypogastric or vesical plexus). These are two loosely-constructed masses of nerve tissue situated one on each lateral aspect of the rectum near the base of the bladder.

2. The *parasympathetic* nerves of the bladder are derived from the anterior roots of the 2nd, 3rd, and 4th sacral nerves, which unite to form the pelvic nerves or nervi erigentes. These also end in the hypogastric ganglia; there are no direct branches from the sacral nerves to the bladder.

Both the sympathetic and the parasympathetic nerves destined for the bladder therefore pass into the hypogastric ganglia. From these ganglia, the ultimate nerves of the bladder spread over that viscus. In, and distal to, the hypogastric ganglia it is of course impossible anatomically to distinguish sympathetic from parasympathetic fibres.

3 The *somatic* nerves are distributed to the external sphincter and posterior urethra through the pudendal nerves.

THEIR SEGMENTAL LEVELS IN THE CORD.

The central connections of the afferent sympathetic fibres from the bladder have been placed by Learmonth (1) between the 9th thoracic and 4th lumbar. That fibres enter the cord so high, explains why after transection of the cord in the lumbar or sacral portion, distension of the bladder can still be appreciated to some extent, since afferent fibres will still enter the cord above the site of the lesion. The efferent sympathetic fibres for the bladder are

connected with the 1st and 2nd lumbar segments of the cord.

The parasympathetic, both efferent and afferent, usually arise from the 2nd, 3rd and 4th, and the somatic from the 3rd and 4th sacral segments.

THEIR CONNECTIONS WITH THE BRAIN.

The paths in the Central Nervous System which connect these cord centres with the brain are not accurately known. The efferent pathway is probably in or near the crossed pyramidal tracts since in disease of the spinal cord, e.g., disseminated sclerosis or syringomyelia, if *both* crossed pyramidal tracts are affected, voluntary control over micturition is disordered. The afferent pathway is altogether a mystery.

THE IMPULSES CARRIED BY THE VARIOUS NERVES.

(a *Parasympathetic.* — The efferent impulses carried by the parasympathetic cause augmentation of the rhythmic contractions of the detrusor muscle. That the parasympathetics are the motor or excitor nerves to the bladder muscle is proven by the paresis or paralysis that follows a lesion in this pathway.

It is also generally stated that the parasympathetic causes a relaxation of the internal sphincter. That this is so, is agreed upon by recent investigators (5) and (6), but they maintain that it is secondary to the contraction of the detrusor muscle, that micturition always begins as an active and sustained contraction of the bladder musculature, and that the sphincters have little individual activity separate from that of the vesical musculature.

The afferent impulses for the normal reflex must be mostly carried by the parasympathetic. This is proven by the fact that micturition can be carried out normally after sympathetic neurectomy (1) but after injury or disease of the sacral posterior nerve roots as in tabes, bladder sensation is much diminished (7).

In addition, there is some evidence that the bladder mucosa is sensitive to heat, cold and touch, (8) as well as to pain and distension. It is rather odd that such sensibility should be present, if it actually is.

(b) *Sympathetic.*—The efferent impulses carried by the sympathetic have been said mainly to reinforce the closure of the internal sphincter and inhibit the contraction of the detrusor. As regards the sphincter, Learmonth (1) uses the word "reinforce," because the sphincter remains closed after sympathetic neurectomy. Its closure must, therefore, be merely reinforced by the sympathetic. With reference to the detrusor, the usually accepted view is that sympathetic impulses "unlock" the tonus of the muscle fibres so that the bladder may be passively dilated to a greater capacity. In this way, as the bladder keeps filling, the muscle fibres will keep relaxing.

The sympathetic therefore seems to be the pathway through which subconscious reflex inhibition of bladder contraction is accomplished. Some doubt has, however, recently arisen as to whether the sympathetic is the pathway used during conscious voluntary inhibition of micturition in man. It is theoretically possible for this function of conscious voluntary inhibition of micturition to be either an active inhibition through the sympathetics, or a decrease of the normal activity of the parasympathetics. Denny-Brown and Robertson (5) demonstrated in normal persons active inhibition of the waves of bladder contraction by an effort of the will. They also maintained (9) that in persons with complete section of the parasympathetics, but with the sympathetics intact, this cerebral control was lost. They therefore concluded that cerebral inhibition of micturition was effected by means of an inhibitory action on the outgoing parasympathetic neurons in the spinal cord. Animal experiments (6) do not confirm this idea at all; they show that all inhibitions of bladder contraction is mediated through the sympathetic pathway, but this find-

ing may only apply to subconscious reflex inhibition, since, of course, the mechanism of voluntary control cannot be studied in animals.

The afferent impulses carried by the sympathetic convey some of the pain sensation from the bladder. This is shown by Head and Riddoch's (10) patient who after destruction of his posterior nerve roots could still experience discomfort when his bladder was distended. It is further confirmed by Learmonth's (1) report of a patient at operation, who, when the central cut end of his presacral nerve (sympathetic pathway) was stimulated, complained of what he characterized as "a crushing pain in my bladder."

Therefore bladder pain is probably carried at least partially by the sympathetic nerves. This seems to supply some rational basis for sympathetic neurectomy for the relief of bladder pain.

(c) *Somatic.* — The somatic nerves are the motor nerves to the external sphincter and carry afferent impulses from the region of the posterior urethra.

A study, therefore, of the impulses carried by the various nerves of the bladder shows that the sympathetic nerves are surprisingly unimportant and may be cut without seriously affecting micturition. What function they do have is related to relaxation of the bladder during filling. The important nerves to the bladder are the parasympathetic; they are functionally concerned with emptying it.

Bladder Tone and the Act of Micturition.

The phenomena of tone in the urinary bladder have been much studied. Many years ago (1882), Mosso and Pellacani (11) passed a catheter into the bladder of the living person and measured the internal pressure under varying conditions of filling and emptying. The pressure usually ranged around 15 cms. of water, and within certain limits seemed quite independent of the volume of fluid in it. If more fluid were pumped in, the pressure rose momentarily but soon fell to its original level of 15 cms. water, and similarly if fluid were allowed to escape through the catheter the bladder pressure fell for a short time but soon readjusted itself. The bladder therefore adapts itself to its contents in such a fashion that the internal pressure is always about the same. It, as Samson Wright (7) says, "enfolds its contents with the same light grip whether they be ample or little."

In smooth muscle such tone as this is not so completely dependent on reflex nervous impulses as in voluntary muscle, and this power of adaptation of the bladder to increasing contents may therefore be inherent in the bladder musculature. But it is more probable that this active relaxation during filling is normally carried out reflexly. In this reflex, afferent impulses from the filling bladder pass to the spinal cord and efferent sympathetic impulses probably cause the bladder wall to relax and thus lower the intravesical pressure, while at the same time they reinforce the closure of the internal sphincter.

However, recent work by Barrington (12) in England, and by Langworthy and Kolb (13) of Johns Hopkins, indicates that this is not a pure spinal reflex, but that tone in the bladder is controlled by a centre in the midbrain.

In this way up to a certain point of distension the bladder is regulated reflexly without conscious voluntary effort. Should the bladder contents, however, exceed this limit, the muscle fibres will relax no further and therefore the intravesical pressure will begin to rise as its muscle fibres are increasingly stretched. When the pressure reaches 18 cms. of water, afferent impulses travelling chiefly by the parasympathetic pathway reach the cerebral cortex, where they result in a consciousness of bladder fulness and a "desire to micturate."

The further sequence of events then depends upon circumstances.

Voluntary Control of Micturition.

If it is inconvenient to micturate, impulses from the cerebral cortex cause the bladder wall to still further relax. The pathway taken by these inhibitory impulses from the cortex was discussed before; it will be remembered that Denny-Brown and Robertson (5,9), concluded that they acted on the parasympathetic neurons in the cord, while all animal experimentation (6), showed that inhibition of bladder contraction could only be brought about by impulses that travelled over the sympathetic pathway. In any event, as the capacity of the organ is in this manner increased, its internal pressure falls once more to the normal 15 cms. level, the afferent impulses from it cease, and the "desire to micturate" for a time passes off.

On the other hand the bladder may be voluntarily emptied in response to this "desire to micturate." In this case the cerebral cortex acts on the sacral segements and impulses go out from these along the parasympathetic pathway so that the bladder wall contracts and the sphincter relaxes. In normal individuals after babyhood, this control by the brain is required for micturition to take place. In infancy, however, the rise in intravesical pressure to 18 cms. initiates a parasympathetic reflex through the spinal cord which, without the higher centres being consulted, empties the bladder.

But even if the bladder is not full and therefore no sensation of bladder fulness is present, micturition can, of course, still be performed perfectly. Since cortical control of any voluntary act is usually assumed to be through the agency of striated muscles, it is often stated (7) that voluntary micturition is initiated by a contraction of the abdominal muscles or by holding the breath with the glottis closed. This is said to increase the intra-abdominal pressure, and hence the intravesical pressure, and thus supposedly forces the sphincter to open. That this is the mechanism of voluntary micturition is by no means certain; personal observation by many observers (14), including myself, fails to confirm the idea that a contraction of these striated muscles need necessarily occur at the beginning of micturition. It seems to me that voluntary contraction of these muscles could easily be subjectively appreciated if it were present. Furthermore, careful experiments (5) in which abdominal wall movements were measured during micturition, showed that abdominal wall contraction was not necessary for initiating micturition, though it could be of help in completing the act.

As a matter of fact, all that actually seems to be necessary for voluntary micturition to occur is the proper environment and the proper volitional mental attitude. When these two factors are present, micturition occurs, through co-ordinated contraction of the detrusor and relaxation of the sphincter. Since these are supplied by the parasympathetic, the only conclusion one can come to is that it must be possible to exercise the will through autonomic nerves.

This conclusion that the will can be exercised through autonomic nerves, at any rate, as regards micturition, seems to be confirmed by the following evidence. The human female has excellent control of micturition, including the power of voluntary cessation of it during the act, yet the external sphincter is said to be anatomically negligible (1). If this is true, voluntary sudden stoppage must take place through voluntary relaxation of the detrusor and contraction of the internal sphincter; and as there seems to be no reason why the neurological connections should be different in the two sexes, this conclusion must also hold good for voluntary sudden stoppage in the male.

That the external sphincter plays an important part in the male must, however, still be conceded, since, as MacAlpine (15) says, "it is the external sphincter alone on which we can depend for post-operative continence" after

prostatectomy, since the internal sphincter may be permanently injured.

Further evidence is provided by the case of two male patients (15), one of whom had an excision of a rectal carcinoma, the other perineal tuberculosis. Both recovered and noticed no alteration in the act of micturition. Many years later both developed prostatic hypertrophy with urinary obstruction, and prostratectomy was done. Both were incontinent afterwards. Ordinarily after prostatectomy, though the internal sphincter may be destroyed there is no incontinence, due, as we stated before, to the continued action of the external sphincter. But in both these cases it is certain that their previous disease had destroyed their external sphincter or its nerve supply. They must, therefore, have had for many years complete *voluntary control* by means of their *internal* sphincter.

Recently, careful experiments on the human have been done by Denny-Brown and Robertson (5) in England, to try to determine the mechanism by which the bladder is subjugated to the control of the will. These have led them to suggest that, with rising intravesical pressure, reflex rhythmical contractions occur in the bladder wall, but that this activity is normally checked by a subconscious inhibitory process acting on the outgoing parasympathetic neurons of the spinal cord. As the bladder fills, this inhibition rises into consciousness, and becomes more or less a voluntary effort to keep the bladder from contracting. Micturition occurs when this inhibition is removed; that is, to micturate, the individual simply releases a restraint of which he is definitely conscious, and the bladder is allowed to contract and empty itself.

This suggestion that the cortex has an inhibitory action on bladder contraction is very interesting in view of the experimental work referred to before (12) and (13), which indicated that, like the general skeletal musculature, the bladder receives tonic nervous impulses from the mid-brain. If these two findings are considered together, it would appear that tone in the bladder is the result of a balance between inhibitory impulses from the cortex and tonic impulses from the mid-brain. This might be analagous to the control of skeletal muscles by both the pyramidal and extra-pyramidal tracts.

But this analogy with skeletal muscle cannot be pushed too far, since, though in a sense voluntary, the act of micturition differs somewhat from the willed activity of skeletal muscles. For example, trifling distractions, e.g., unusual posture or embarrassing circumstances, may prevent the act altogether, in spite of strong voluntary effort and even in spite of definite "desire to micturate". There is no analogy to this in skeletal muscle movements. The role of psychic factors in micturition is further exemplified by their influence on bladded tonus. For instance, in moments of emotional stress as before an examination, the bladder's power to elongate its fibres as its contents increases seems to be lost. The well-known result is a constant desire to micturate with the passage of but small amounts of urine each time.

It has been suggested, therefore (14), that voluntary micturition belongs rather to the realm of conditioned reflexes, and is an example of an autonomic reflex being brought under psychic control, so that by psychic factors alone it may be effected or inhibited, under proper environmental conditions.

Two conceptions of the mechanism of voluntary micturition have therefore been suggested:

1. That the cerebral cortex acquires control of micturition by building up an inhibition of the bladder's reflex rhythmic contractions.

2. That the exercise of the will through autonomic nerves, which seems to occur in voluntary micturition, is brought about by the development of a conditioned reflex.

These two concepts do not seem to me to be contradictory. On the con-

trary. putting the two ideas together—the cortex has not the power in babyhood to inhibit the bladder's rhythmic contractions but acquires this power through the development of a conditioned reflex.

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SOME CLINICAL ASPECTS OF TUBERCULOSIS AND DIABETES

By W. M. TOONE, B.A., '37.

Tuberculosis and diabetes have long been associated, with tuberculosis more often a complication of diabetes. Not that a person suffering from diabetes is more likely to develop tuberculosis (that person would probably have contracted tuberculosis if he had not diabetes), but because diabetes renders the individual less resistant to the tubercle bacilli. The incidence of tuberculosis contracted by the diabetic is shown by the following: (1) Wendt and Peck state that 4% of 1,073 cases of diabetes had developed tuberculosis after diabetes had been treated for some time. (2) Among 8,000 cases of pulmonary tuberculosis Wassmud found 60 diabetic. (3) Fitz reports 35 cases of active pulmonary tuberculosis in 1,529 patients with diabetes seen in the outpatients department of Peter Bent Brigham Hospital in the last seven years. It would be interesting to know the incidence of tuberculosis and of diabetes in the general population, but these figures unfortunately are not available. On the other hand, very few cases have been reported of patients suffering from tuberculosis later developing diabetes. When these two diseases are associated a definite problem arises in the treatment of them. Three cases are presented below which show the the instability of a diabetic with tuberculosis and the difficulty often encountered in confronting tuberculous diabetics with the usual methods of treatment.

Case I.

J. B., Male, age 29, weight 120 pounds, was admitted to Fort San, Saskatchewan, on December the 12th, 1931, with pulmonary tuberculosis and diabetes. The tuberculosis involved the upper half of the right lung with cavitation, and the symptoms of diabetes had been present for two years previous to the entrance to the sanatorium. The patient was dieting on admission to hospital and receiving no insulin, but as sugar was found in the urine, insulin treatment was started immediately. His diet per day was Protein 71 grams, Fat 100 grams, Carbohydrate 152 grams. Table I. shows treatment of the diabetes and reactions from that time to the present date.

The table shows the instability of this diabetic suffering with tuberculosis. Blood sugar estimations done at hourly intervals throughout the day vary from .05% to .35%. The tuberculosis aggravates the diabetes, inasmuch as it was seen that as the pulmonary disease progressed the carbohydrate metabolism became more upset. A high kidney threshold is sug-

Table I.

Date.	Insulin Dosage.	Blood Sugar.	Urine Sugar.	Remarks.
Dec. 14/31	12-12 units			
Dec. 16/31		.28%	neg.	
Dec. 30/31		.39%	pos.	every two hours.
Dec. 31/31	15-15 units			
June 5/32				Diet increased to Protein 90 grams, Fat 100 grams, Carbohydrate 160 grams.
Aug. 10/32				This amount of Insulin keeping patient comfortable. 15 lbs. gain in weight since entrance to sanatorium.
Aug. 10/32				Right sided pneumothorax therapy introduced.
Mar. 1/33				Pulmonary disease definitely extending.
Mar. 10/33		.35%	pos.	
Mar. 11/33	15-20 units			Pneumothorax discontinued owing to adhesions.
June 1/35			pos.	X-ray examination showed definite extension of Tuberculosis to opposite lung.
June 2/35	20-20 units.	.3%	neg.	
Jul. 21/35	20-10-20 units	.32%	pos.	
Jul. 29/35	22-12-22 units	.23%		
Aug. 5/35				Patient complained of weakness, blurring of eyes and felt considerable anxiety. 10 grams of glucose were given which relieved the symptoms.
Aug. 6/35		.33%	pos.	In the afternoon of this day patient had just started his dinner when he suffered a complete collapse, became unconscious and pulseless. 10 grams of glucose were given and the juice of three oranges, and he spent a good night.
Aug. 7/35	20-10-20 units			Diet increased to Protein 90 grams, Fat 120 grams, Carbohydrate 170 grams.

gested here, for fasting blood sugars over .25% usually over flow into the urine. A high blood sugar is present at certain periods during the day but this cannot be brought to normal (.15%) by increased insulin dosage because at other periods of the day the blood sugar, as shown by the curve, is quite low. This explains why this patient with a blood sugar of .33% one hour should have a definite hypoglycaemia a few hours later, following a moderate dose of insulin. The amount of sugar in the blood varies a great deal, for an hourly blood sugar curve the next week would present an entirely different picture.

Case II.

D. G., Male, age 22, was admitted to Fort San. July 18th, 1935, with extensive pulmonary tuberculosis involving the right lung and complicating diabetes. He stated he had been suffering from diabetes for ten years and at the time of admission was receiving 20 units of insulin at breakfast and at supper. On examination urine showed considerable sugar, and blood sugar at fasting was .37%. His diet had been picked at random while at home, so a diet was made up for him consisting of Protein 80 grams, Fat 130 grams, Carbohydrate 150 grams.

This patient on entering the sanatorium was acutely ill with his pulmonary infection. Haemoptysis (6 ounces) and marked weakness had been experienced the day before.

By raising the insulin dosage to clear the urine and lower the blood sugar, a series of hypoglycaemic reactions were experienced by the patient. His blood sugar at one period was as

Table II.

Date.	Insulin Dosage.	Blood Sugar.	Urine Sugar.	Remarks.
July 20/35	20-15-20 units			
July 21/35		.33%	6.4 grams	
July 24/35	26-20-26 units			
July 30/35			1.8 grams	
July 31/35				At 5.30 p.m. patient suffered from hypoglycaemia. 10 grams of glucose given.
Aug. 1/35		.06%		At 4.30 p.m. definite hypoglycaemia again experienced. Blood sugar taken at the time=.06%.
Aug. 3/35	26-15-21 units 5 units at 3 a.m.			
Aug. 5/35				Patient again suffered a hypoglycaemic reaction.
Aug. 6/35	21-5-21 units. 5 units at 3 a.m.			Diet Protein 85 grams, Fat 130 grams, Carbohydrate 70 grams.
Aug. 10/35				Right sided Pneumothorax instituted.

low as .06%. (Table II). His blood sugar curve resembles that of Case I, for at certain periods of the day it was up and at other periods it was down considerably below normal. It was found to be useless to give larger amounts of insulin when the blood sugar was high, for these periods varied greatly from day to day.

Case III.

W. S., Male, age 21, entered Fort San. October 20th, 1934, with a right sided pleural effusion which extended to the third rib anteriorly, and also diabetes. Temperature on admission was 102.5, weight 112 pounds. Blood sedimentation index 28 m.m. per 60 min. Sugar in urine. The patient had ex-

Table III.

Date.	Dosage. Insulin	Sugar. Blood	Sugar. Urine	Remarks.
Oct. 21/34	15-15 units		pos.	Diet: Fat, 50 grams, Protein 60 grams, Carbohydrate 100 grams.
Oct. 23/34	15-10-10 units		pos.	
Nov. 5/34				Patient losing acute symptoms. Diet: Carbohydrate 120 grams, Fat 60 grams, Protein 60 grams.
Nov. 6/34			neg.	
Jan. 18/35				X-ray showed considerable extension of pulmonary disease involving the parenchyma of both lungs.
Apr. 1/35			pos.	
May 1/35	20-15-15 units	.54%	pos.	
May 16/35		.38%	neg.	
Jul. 1/35	26-17-17		pos.	
Jul. 3/35	28-20-20		pos.	
Jul. 17/35	30-20-20	.37%	neg.	Diet increased. Protein 90 grams, Fat 120 grams, Carbohydrate 170 grams.
Jul. 22/35	20-26-26	.37%		
Jul. 24/35				Patient experienced symptoms of hypoglycaemia at 4 p.m.
Aug. 2/35	20-22-20	.31%	neg.	

perienced symptoms of diabetes for three years and had been receiving insulin, the amount not being available to record. (Table III).

Comments:

These patients show a definitely high blood sugar, and Case I is now feeling well as regards his diabetic condition, with fasting blood sugar at .23%; Case II at .31% and case III at .37%. Their blood sugar does reach normal and below normal during the day, thus saving them from acidosis. Because the amount of sugar in the blood varies such a great deal, it is extremely difficult to bring the blood sugar to normal. Also these patients, probably because of their pulmonary lesions, are very unstable and if their blood sugar were brought to normal, upsets in their carbohydrate metabolism would occur with the daily flooding of their systems with toxins. Therefore, these patients seem to feel much better when their blood sugar is at the level of .3% rather than at a normal level of say .15%, for this high level gives some leeway for increased carbohydrate metabolism arising out of "flare-ups" in their pulmonary tuberculosis. I think, in diabetics with tuberculosis, that the urine should be kept just free of sugar, rather than run the risk of causing an hypoglycaemia, which is most distressing to these patients. For cases I and II who underwent extension of their pulmonary tuberculosis did not suffer upsets in their carbohydrate metabolism until the pulmonary disease had advanced to a very considerable extent.

Of 18 cases of tuberculosis with diabetes seen in this hospital in the past 7 years, 16 had a fasting blood sugar above .3% and two above .25%. Doubtless many investigators have made this observation, but in going over a considerable portion of the literature H. Kutschern-Aichlengen (4) is the only person who points out this increased blood sugar in diabetic cases with tuberculosis.

Diabetes does not contra-indicate any treatment for pulmonary tuberculosis; pneumothorax was instituted in two of the cases. For, far from contra-indicating pneumothorax, diabetes ought to hasten the intervention to check the tendency towards extension of the pulmonary lesion so evident with glycosuria. In treating tuberculosis with diabetes very liberal diets are allowed with a high carbohydrate content as opposed to the low calorie-high carbohydrate diet now advocated. Thsi is in accordance with the findings of I. M. Rabinovitch who states, "Tuberculosis still remains the one condition in our diabetic clinic in which very liberal diets are allowed." (5)

I have found this problem intensely interesting, chiefly because it arose out of practical experience in a sanatorium where the staff was confronted with the difficulties of treating these two diseases together. Then, too, there is very little reference in the literature to these clinical aspects of tuberculosis and diabetes.

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EVIDENCE FOR THE NEUROGENIC ORIGIN OF PEPTIC ULCER

By W. L. M. KING, '37.

The object of this article is to bring together all the evidence to date favouring the neurogenic theory of origin of peptic ulcer and to attempt to weld the various facts, experimental and clinical, into some sort of concrete chain which might account for ulcer formation in the majority of cases. The writer, having performed no experimental research himself on ulcer formation, is basing his conception entirely on the recent work which has been done during the past four or five years along this line and which is now being carried on by workers all over the world.

The "Ulcer" Personality.

It is well known to medical men that duodenal and gastric ulcers are prone to occur in those individuals who are bearing the weight of heavy responsibility, who are subjected to continual worry and mental strain, and in those who tend to be nervous and excitable. Moreover, those ulcers tend to heal when the load is removed. "Nervous indigestion" is a common experience of every one. That empty feeling in the stomach before writing an important examination, before making an after-dinner speech, etc., is very possibly due to the psychic inhibition of gastric function with increased sympathetic activity of the stomach in accordance with the generalized sympathetic toning-up of the body. The following paragraphs will attempt to show how this same mechanism may play a highly important role in the production of peptic ulcer.

The Nervous Mechanism of the Stomach.

A. Innervation of the Stomach.—The stomach is innervated solely by the autonomic nervous system, from which it derives a dual supply. The first is the para-sympathetic which reaches the stomach via the right and left vagus nerves, the fibres of which synapse around nerve cells in the plexus of Auerbach. This is the secreto-motor supply to the stomach, stimulation resulting in increased HCL secretion, hypermotility, and hypertonicity of the wall. It causes the pyloric sphincter to relax. The second is the sympathetic which comes to the abdomen from the fifth to the twelfth thoracic segments of the cord via the three splanchnic nerves and the solar plexus. Terminal fibres from the latter may comprise the plexus of Meissner within the stomach wall. The function of the sympathetic is gastrostatic, stimulation causing the stomach wall to become flaccid, the pyloric sphincter to tighten, and the arterioles in the mucous membrane to constrict. Sensory fibres reach the brain from the stomach via the vagus nerves and the grey sympathetic rami.

B. Intermediary Autonomic Pathways.—The vagus nerves consist of axones of nerve cells lying below the floor of the fourth ventricle in the medulla oblongata. The sympathetic nerve fibres are axones of nerve cells in the lateral horns of the spinal cord, leaving the anterior roots of the 6th, 7th and 8th dorsal segments as the white rami communicantes. These pass to the corresponding paravertebral sympathetic ganglia but do not end there, passing straight through, leaving as the three splanchnic nerves, to end by synapsing around nerve cells in the coeliac plexus.

C. The Higher Autonomic Centres.—Linell, in his recent paper on the autonomic nervous system, has given very

clearly the evidence concerning the exact location of the higher autonomic centres in the interbrain. In brief, the connections are believed to be as follows. The foremost centre of the parasympathetic lies in the tuber cinereum. Axones from the tuberal nuclei are thought to travel backwards through mid-brain, pons and medulla to synapse around the cells of the vagal nuclei. Beattie showed that electrical stimulation of the tuber and infundibulum produced increased motility of, and secretion in the stomach, increased bladder tonus and movement, slowing of the heart, and patches of hyperaemia in the stomach mucosa—all vagal effects. Secondly, the foremost centres of the sympathetic lie in the posterior portion of the hypothalamus, the axones from these cells passing backwards through the brain stem and down the cord to synapse around cells in the lateral horns. Evidence for this was produced by Beattie and Sheehan, who stimulated electrically the posterior hypothalamus and got lowered intragastric pressure, rise in blood pressure and obliteration of all gastric activity —all sympathetic effects. Both the tuberal and hypothalmic nuclei receive efferents from the supra-optic nucleus located in the lateral wall of the third ventricle just above the anterior commissure. The same body sends efferent fibres to the posterior lobe of the pituitary. The supraoptic nucleus, in turn, receives efferents from the anterior nucleus of the thalamus to which go the impulses from the frontal lobe cortex. In this way there is established an anatomical basis for the theory that impulses from the frontal cortex can play on both parasympathetic and sympathetic nuclei.

Before leaving this subject, it is of considerable interest to note that the tubercinereum has been found histogically to possess no ependymal lining. Cushing feels that posterior lobe secretion normally passes up the stalk of the pituitary body into the cavity of the third ventricle and that such passage is regulated by impulses passing to the posterior lobe from the supra-optic nucleus. He has proven experimentally that posterior lobe extract injected into the third ventricle produces gastric hypermotility and hyperaemia. There seems to be a definite basis, therefore, for his theory that posterior lobe secretion, having reached the third ventricle, passes via tiny channels into the tuber cinereum and stimulates the para-spmpathetic nuclei within it.

Peripheral Mechanism of Ulcer Formation.

All observers are agreed that ulcers form in the stomach by the production of multiple localized areas of ischaemia and infarction which devitalize the mucous membrane at that point to such an extent that it undergoes digestion by its own acid juices with subsequent necrosis and sloughing. Whether this local ischaemia is due to parasympathetic or sympathetic hyperactivity seems to be much disputed. If it is due to the former, the mechanism of production is probably this, parasympathetic hyperactivity results in spasm of the muscular wall which squeezes shut the small arterioles, thus producing ischaemia, and in secretion of an acid of greater strength and in greater amount which has a more damaging effect on the stomach mucosa than it normally would. Cushing believes that it also causes a certain amount of spasm of the vessel walls. If the ischaemia is due to sympathetic overactivity, it is likely that the arteriole walls become spasmodically contracted, shutting off the blood supply to the corresponding areas of stomach mucosa and thus producing ischaemia.

Central Mechanism of Ulcer Formation.

Here again the question arises as to whether the mechanism is one of sympathetic or of parasympathetic release or stimulation. The evidence for the

two sides will be presented as experimental and as clinical evidence.

A. Experimental Evidence.

(1) *Electrical and Mechanical stimulation*: It has already been cited how Beattie, by electrical stimulation of the tuber and infundibulum, produced vagal effects in the stomach. Later, working with Sheehan (1934), he found that stimulation of the tuber in cats under chloralose anaesthesia produced a rise in intragastric pressure, fall in blood pressure, and increased motility of the stomach which effects were abolished by vagal section. Nothing was said about ulcer, however.

(2) *Lesions of higher centres*: It is by this method that the greatest amount of experimental work has been done. In 1935, Watts and Fulton, using monkeys, made lesions in the tuber, supra-optic, and para-ventricular nuclei. They found that lesions of the hypothalamic area produced erosion much more commonly than lesions elsewhere in the brain. The lesions were found to produce cardiac extrasystoles as well as erosion in the stomach and flaccidity. Therefore they attributed the effect to release of the posterior hyperthalamic centres from control of the tuberal and infra-optic nuclei with the production of spasm of the vessel walls in the stomach mucosa. In 1933 Keller, Hare and D'Amour made transverse lesions at the level of the optic chiasma. They found that lesions in this situation without haemorrhage or that haemorrhage into the ventricles would produce gastric erosions with generalized hyperaemia of the stomach and duodenal mucosa. This would seem to indicate a release of the tuberal and posterior hypothalamic nuclei from the influence of the supra-optic nucleus, i.e., hyperactivity of both systems was responsible for erosion. The intraventricular haemorrhage might have produced irritation of those nuclei. In 1935, Hoff and Sheehan made small lesions, confined to the tuberal nuclei, in 16 monkeys. Five cases showed erosion, three of the five being accompanied by dilatation of the stomach. Exactly similar lesions, however, produced no erosions in other cases. However, no control cases and no cases where lesions were made in the posterior hypothalamus showed erosions. These most recent results of all would seem to indicate definitely that overactivity of the sympathetic due to release from the counterbalancing effect of the tuberal impulses was responsible for the gastric erosions. These workers feel, however, that vasomotor disturbance is not the only factor in the production of localized ischaemia of the gastric mucous membrane but increased motility and secretion due to vagal irritation also play a part. Therefore, all the recent observers seem to favour sympathetic hyperactivity. On the other side is Cushing, who states in his Balfour paper that the experimental lesions which, with greatest constancy, have led to erosion, have either been sympatho-paralytic or vago-stimulatory. In support of this, Klein reports considerable success in abolishing gastric hyperacidity following partial gastrectomy, by section of the left vagus nerve.

(3) *Pharmacological effects*: In 1934, Dodds, Noble and Smith demonstrated that an acetone-picric acid extract of pituitary glands injected subcutaneously into rabbits produced gastric erosions. From this they concluded that the posterior lobe contains a gastro-toxic hormone capable of producing erosions and that it exerts this effect either by direct poisoning of the stomach cells or by stimulating them to secrete excess acid to a damaging extent. This would be a vagal effect. In 1932, Light, Bishop and Kendall injected pilocarpine into the lateral ventricles of animals and produced erosions due to anaemia of the gastric mucous membrane accompanied by surface haemorrhages. They attributed this to stimulation of parasympathetic centres in the 3rd ventricle. Histologically they found a definite and consistent contraction of the mucosal vessels

leading to ischaemia with digestion. This supports Cushing's view that vagus stimulation may produce vasomotor spasm. Cushing injected pituitrin into the ventricles and got the same effect as he did with pilocarpine. He attributed this to stimulation of the tuberal nuclei by the pituitrin and suggests that this occurs normally in health.

B. **Clinical evidence.**—Cushing describes several cases where intra-cranial lesions in patients were complicated or followed by acute erosions of the stomach. In all of these he attributes the erosions to irritation either of the parasympathetic fibre tracts or of the vagal centres in the brain. Linell describes a case of tuberculous meningitis which showed at post mortem definite ante-morten acute ulcers of the stomach. This, he felt, was due to irritation of nuclei in the floor of the third ventricle.

Summary.

From the vast amount of contrary evidence that we have, one is in no position to dogmatize about a neurogenic theory of gastric ulcer. Lesions producing erosions in the stomach are just as likely not to produce them. The trouble is that no one has a needle fine enough or a technique perfect enough to destroy the same fibres in each animal. Until this is attained, not much further progress will be made along the experimental line. Pharmacological and clinical evidence points toward irritation or release of the parasympathetic; the most recent experimental evidence seems to favour release or irritation of the sympathetic but admits that parasympathetic irritation plays an important part in the mechanism of ulcer production. Therefore, the most reasonable explanation of acute ulcer formation in the stomach, from a neurogenic standpoint, seems to me to be an irritation both of the parasympathetic and sympathetic centres or tracts producing vaso-constriction in the mucosa, muscle spasm and hypersecretion, resulting in local areas of ischaemia and infarction which devitalize the mucosa, so that it is digested by its own hyperacid juices. As regards chronic ulcer and the production of ulcer in the "ulcer" personality, the most pleasing conception to my mind is this: is it not possible, by virtue of constant worry and mental strain, to have a continual stream of subliminal impulses from the frontal lobe cortex impinging on the anterior nucleus of the thalamus and hence the supra-optic nucleus, and that these cause a constant irritation of the tuberal and posterior hypothalamic nuclei, not sufficient to produce acute ulcer, but enough to set up a gradual ischaemia of the stomach mucosa with a devitalization of the mucous membrane in some particular area, resulting in the formation of a chronic peptic ulcer?

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ANAESTHESIA BY CYCLOPROPANE

By HUBERT HAYWARD, B.A., '37.

Surgery owes its advances as an art (the art of healing) and as a science, to the discovery and subsequent widespread use of anaesthetics.

It is in this light, then, that we judge the merits of an anaesthetic.

The art of healing implies that we are dealing not with an end product, but with a process. Let us, then, trace those aspects of the process in which anaesthesia is used, throughout a hypothetical case—which will approach in principle as close as present knowledge allows, to the ideal.

The Anaesthetic.

For this purpose the anaesthetic was much more difficult to obtain than the patient. Patients have existed throughout the ages of man (and it is one of the ironies of medicine that they continue to), but it was not until Henderson and Lucas in 1929[1] published their findings on cyclopropane, that surgeons had visions of an ideal anaesthetic. It was not until H. C. Wardell, Jr., of the Ohio Chemical and Manufacturing Co.[3] developed a commercially satisfactory methods for its preparation, that its price came within the reach of all. Wardell believes his preparation to be 99.5% pure. Such impurities as there are, are non-toxic. Cyclopropane is capable of compression and the ordinary "B" cyclinders in which ordinary anaesthetic gases are supplied under several hundred pounds pressure, will contain fifty gallons of cyclopropane at a pressure of only seventy-five pounds to the square inch. Its market price approximates fifty cents per gallon. The process is still in principle the one used by Willstätter, namely—the reduction of trimethylene bromide in alcoholic solution with zinc dust. Impurities may be absorbed with potassium permanganate solution. It is assayed by absorption in concentrated sulphuric acid.

The Patient.

Concerning the choice of patient and operation we refer to the report of the Anaesthesia Department of Wisconsin General Hospital, for 1934, where clinical investigation regarding cyclopropane has been most thoroughly and enthusiastically done.

Of 4,133 cases on their service, 56.69% were done under cyclopropane anaesthesia. Risks were classified E (emergency), A, B, C, D, DD, ID. Of the D and DD risks 67.88% were done with cyclopropane. All types of service were involved: Surgery, Orthopedic, Gynecology, G.U., E.N.T., Plastic, Obstetric, Dental and Eye. 95.94% of these cases were considered "satisfactory" by the staff of surgeons. For the individual anaesthetics, 94.35% of those done with ether, 98.11% with N_2O and 95.73% with cyclopropane were similarly classified from the surgeon's standpoint.

The more careful the perusal of their figures the more impressed one is by the fact that when the anaesthetic used is cyclopropane there is less need for consideration of the risk or type of operation, than with any other anaesthetic used.

Premedicants.

Premedicants are not as essential with cyclopropane as with ether or chloroform, and Bourne reports[2] satisfactory (and not unpleasant) induction, maintenance and recovery in cyclopropane anaesthesia without their use. For Caesarian sections he uses only atropine gr. 1/150. As a rule morphine gr. ⅛ - ¼, plus scopolamine gr. 1/200 - 1/100 one and one half hours

previous to induction is recommended.[3 8] As cyclopropane is not a respiratory stimulant, depression of the respiratory centre by premedicants is to be avoided as far as possible.

The Induction.

The physical properties of importance when handling the gas are its weight—it is heavier than air: and its explosibility—it is explosive in mixtures of 5% and upwards in oxygen, while mixtures above 10% in air are non-explosive.[1] Its density of 1.46 approximates that of carbon dioxide, so that it can be used in a flow-meter calibrated for that gas. Its expense necessitates a closed system of induction, which has proven so satisfactory as to reduce the quantity of gas required to an average of 1.79 gals. per case.[7]

The technique commonly employed at the Wisconsin General Hospital, where extensive clinical investigation of cyclopropane is being carried on, is briefly this: A carbon dioxide absorption technique is followed, a soda lime canister being inserted into the system as soon as induction is complete, or earlier if hyperpnoea is not desired. "Administration commences with a very rapid flow of oxygen (8-10 litres per min.) into the mask as it is being applied to the patient's face, and this continues until the mask, canister and bag are sufficiently filled to accommodate the patient's tidal excursion. At the same time cyclopropane is introduced at a rate of 600 c.c. - 700 c.c. per min. and continued for 2-3 mins. and then stopped. Oxygen is added as required to meet the patient's metabolic demands, 250 - 400 c.c. per min. of oxygen usually being required."[8]

An endotracheal catheter can be introduced fully as easily as with ether, in fact the laryngeal reflex is eliminated more quickly than with ether.

Concentrations of 10-11% will maintain surgical anaesthesia in cats; rabbits appear to require 14-15% and toxic features develop rapidly only in concentrations of 18-20%. 16% and upwards may produce a fall in blood pressure but this is not of serious extent in cats. Decrease in respiratory rate and excursion is usually the first indication of toxic effects and is found in dogs when double the concentration (24%) required for surgical anaesthesia is used.[1]

In man cyclopropane is effective in concentrations as low as 4%. Plane I requires 7.4%; plane II 13.1%; plane III 23.3%. Stage IV, with respiratory arest, requires 42.9%. Even after a period of artificial respiration ill effects are difficult to find.[8] Oxygen concentration must always be decidedly greater than 20%. If the depth to which anaesthesia has progressed is in doubt, oxygen must always be added to the system.

With cyclopropane it is to be noted that we are administering oxygen with anaesthetic, not anaesthetic with oxygen. This appears in a more important light in obstetrics where abundance of

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oxygen is good for both mother and foetus, especially the latter if it has a weak heart.[2]

Induction is rapid, Plane III being reached in 3-5 minutes. During the process no excitement nor reflex secretory activity occurs, for cyclopropane is pleasant to take, having a taste much like a mixture of chloroform and ethylene. Laryngeal spasm occurs only in concentrations greater than 50 per cent.

Because of its ring structure and the paucity of metabolic changes it produces, cyclopropane is believed to form no combinations in the body although in dogs there is evidence to suggest a gradual saturation of the body lipoids. The depth can thus be more rapidly and conveniently varied than with ether.

The signs resemble closely those produced by ether; the pupils, however, tend to be variable rather than small in planes I, II, III and the eyeballs roving in plane I and fixed in plane II.

Any degree of anaesthesia may be conveniently attained. In obstetrical work Bourne produced intermittent analgesia as required for the more severe labour pains and anaesthesia was maintained for delivery procedures. Uterine contractions were not inhibited. Cyclopropane was used in stage II in 5.84 per cent. of cases reported from Wisconsin General Hospital in 1934.

One cannot object to cyclopropane on the grounds that the degree of muscular relaxation obtained is not good[3]. Indeed it is splendid, equal to that produced by ether. An added advantage is the quietness and smoothness of respiration. To say the least, this is very comforting to the surgeon. Since it is not increased in excursion, chest surgery is most conveniently done under cyclopropane.

The duration of the operation is not limited by the choice of cyclopropane as the anaesthetic. In Wisconsin 6 cases have been submitted to four hours of such anaesthesia.

Physiological Changes:—

This gas is an isomer of propylene. (CH_3. CH. CH_2.) Its formula (CH_2. CH_2. CH_2) is a ring structure with no unsaturated bonds. It however, has unsaturated activity, because of its relatively unstable ring structure[3]. It is not believed to form compounds in the body and in this respect differs from bromoform and probably chloroform, which undergo partial decomposition in the body. There is a 10-15% deficit in the amount of ether exhaled after anaesthesia, and this suggests that its effects are due in part at least to the intracellular action of its metabolites. Metabolic changes are evidenced in all anaesthetics, except cyclopropane[3], by increase in blood sugar, decrease in alkaline reserve and increase in blood acidity as shown by chemical analyses of blood and urine before, during and after anaesthesia.

Liver changes may be taken as a fair index of concurrent activity of a drug, elsewhere in the body. In experiments on dogs carried out in the Department of Pharmacology at McGill, liver function was not affected by cyclopropane anaesthesia both in normal animals and in those suffering liver damage from chloroform. The same is true of human subjects both normal and eclamptic and for this examination the bromsulphalein dye test of liver function was used.[2]

Respiration remains almost normal in depth and rhythm throughout. Respiration invariably fails before circulation but requires a concentration of 39% in dogs. At this concentration arrhythmias develop. The initial ones are abolished by atropine, suggesting a vagal origin and disappear when the concentration of anaesthetic is reduced, suggesting that no permanent cardiac damage has been produced[4]. (This concentration it must be noted is extremely high). Waters reports arrhythmias during operation under cyclopropane in 3.2% of cases, 1.3% of which had preoperative circulatory conditions, including myocardial degeneration. Blood pressure is approximately normal throughout. Under ether the blood

pressure is raised practically throughout. An initial rise followed by a fall, due to depression of heart muscle and vasomotor centre occurs under chloroform. Cyclopropane alone seems to have no effect on the vasomotor centre.

Post-Operative Course

Following the operation, recovery of consciousness is very rapid, less than 5 minutes being required. The smell of anaesthetic does not linger on the breath as is does with ether which must be expelled over a long period. No fears of sudden death at this stage, such as sometimes occur on recovery from chloroform anaesthesia, need be entertained. Levy believes these to be due to liberation of adrenaline by reflex stimulation, the presence of which, with chloroform, is believed necessary to cause death.

Post-operative complications have always taken the burnish from operations well done. Of these, respiratory, gastro-intestinal and circulatory disturbances occasion most concern; genito-urinary and central nervous system somewhat less. Nausea and vomiting have always been annoying and unpleasant to the patient. These are marked under ether. With cyclopropane they are probably less frequent and certainly much less prolonged.[5] Because of the absence of metabolic upset one is probably justified in ascribing this to the technique of administration employed. It is much less frequent and of reduced severity in cases that have undergone deep anaesthesia.

In the following table figures from the report of the Wisconsin General Hospital are gathered together in abbreviated form. Their general trend rather than their actual values is of significance.

Percentage of Cases With Post-Operative Complications

Complication—	C_3H_6	Ether	N_2O	Procaine Spinal
Respiratory				
—Major	0.72	1.11		
Pneumonias (Broncho-,Lobar, Hypostatic Collapse (Massive, partial) Pumonary Oedema.				
—Minor	6.02	5.23		
Circulatory				
Tachycardia	8.84	4.29	6.12	
Severe Drop in Blood Pressure	4.65	0.17	3.59	
Total	11.87	6.15	10.11	
Genito-Urinary				
Slight Retention	5.85	1.49	2.95	3.23
Total	8.93	6.15	4.43	12.21
Gastro-Intestinal				
Moderate Distension	8.88	8.78	2.73	14.02
Ileus	0	0.19	0	0.36
Total	11.15	11.03	3.18	17.59
Central Nervous System				
Headaches (moderate)	1.66	1.51	2.11	2.52
Excitement	0.63	0.56	0.63	
Total	5.77	3.92	5.26	5.74

The frequency of deaths attributable with fairness to cyclopropane, is no greater than that occuring in the use of ether or nitrous oxide.

Summary

The author has tried to present the subject matter in an impartial manner.

It appears that cyclopropane has more worthwhile qualities than any of the other anaesthetics. It can be used in all cases in which both ether and N_2O could be used and is very satisfactory both for short and long periods of anaesthesia.

Cyclopropane fails in being ideal only in the occurrence of post-operative complications on which score it at least equals, if not surpasses other anesthetics.

More diligence is required in its use than is the case with other agents, because of the rapidity of passage through the various stages. This fact however makes it a more flexible agent and the pleasantness and ease of induction, together with a resulting state favourable to operative interference commend it highly to both patient and surgeon.

The author wishes to thank Dr. V. E. Henderson for valuable help and criticism.

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25 YEARS AGO

(From the Spectator files of Wednesday, November 2, 1910.)

Toronto, Nov. 2. — This afternoon at the general hospital a number of doctors had presented to them a "recovered patient" who stands unique in the record of medical science in Canada. Most people have read of the rare and somewhat dangerous operation known as the "transfusion of blood," the blood of one being pumped into the veins of another, but never until last week had the operation been performed in Toronto. The operation is rare, first, because it is not often that there are patients with the peculiar conditions that require such drastic treatment, and, second, because it can only be performed when the patient has a friend who is willing to risk his life for him. In this case this sacrifice was offered by the patient's brother, who, knowing the risks and counting the full cost, displayed by his act a fraternal affection as beautiful as any told in story or legend.

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A RECENT STUDY OF THE INTER-CORTICAL SYSTEM OF THE HUMAN CEREBRUM

R. A. GORDON, B.Sc., '37.

It is the writer's purpose in this paper briefly to review recent work on this subject reported by Dr. Rosett of Columbia University. Dr. Rosett's work should be of interest not only to students of neurology in all of its branches, but also to those who are more interested in psychology and psychiatry, for this work was undertaken not as a purely anatomical study, but as part of a study of the convulsive state.

Most investigators agree that epileptic convulsions originate, usually, in some part of the cerebral cortex, and rapidly spread to involve large portions of the brain. This spread determines the way in which the abnormal discharge will make itself manifest—whether as muscular jerkings by involvement of the precentral cortex, as paraesthesia by involvement of the post-central cortex, or as scotoma by involvement of the occipital cortex, to mention a few of the many possibilities. The intercortical system of fibers are the pathways along which these epileptic discharges may travel in the cortical phase of the convulsion.

Beneath the cortex of the fissures of the human cerebrum there extend intricate systems of nerve fibers which run parallel to the surface. The existence of these has been known to neurologists for over a century, but owing to the inadequacy of the methods employed in mapping out their course the conception of these systems has remained vague. It has been the belief that these fibers—the so-called U-fibers—begin at points on the crest of a convolution, pass down the wall of the fissure, curve under its floor, and pass up on the adjoining wall of a neighboring convolution to reach points on the crest directly opposite those from which they start. Rosett has shown in the study under consideration that such an arrangement is true in part only.

Although they had been mentioned before him by Reil, Rolando and Burdach, Arnold (1851) appears to have been the first to call especial attention to the existence of white lines underlying the gray substance not only of the cerebrum, but also of the cerebellum.

The earlier anatomists derived their ideas of the intercortical systems from manual dissection. Needless to say such a method is impossibly crude in this situation, and led to the formation of erroneous conclusions. Later anatomists have used serial sections of cerebral tissue containing tracts of massive degeneration prepared by the Weigert-Pal method. Others, particularly Probst, have used the Marchi degeneration method in addition. Flechsig has pointed out that the method is ill-suited to the study of the intercortical systems. In all methods based on degenerations and the study of cross sections, the final orientation and checking up with direct histological control becomes an evident postulate to any investigator.

Rosett has attempted to develop a method of studying the systems which will eliminate all of these difficulties. The methods used by him in the preparation of the specimens studied are sufficiently unique to be of interest in themselves. The great difficulty in tracing out inter-cortical pathways in the past has been the apparent impossibility of dissecting them out satisfactorily, and the difficulty in integrating their courses, or, in fact, of following

the complete course of a fiber system at all when the method of degeneration is used. The method used by Rosett he has called "Automatic Internal Dissection." The cerebrum is thoroughly fixed in either formaldehyde or a dilute solution of alcohol. This fixation must be such that the tissue is firm and elastic, but not brittle. After fixation the specimen is stripped of the membranes, wrapped in several layers of gauze, then in three to five layers of bandages. It is then placed in a strong, airtight metal container fitted with a pressure gauge and a high-pressure valve with a large opening, which valve can be opened in a fraction of a second. Into the container, (in which the brain has been placed), is introduced liquid carbon dioxide, which at room temperature has a pressure of 850 to 1,200 lbs. The specimen is subjected to this pressure for one or two days in order to allow ample time for the gas to dissolve in the fluid of the brain. The valve is then quickly opened, with the result that the brain tissue explodes. The expansion of the tissue is, however, counterbalanced by the bandages, and instead of disintegrating, the cerebrum is dissected along "natural" lines of cleavage. At those points where there is interweaving of fibers the tissue remains practically intact. Rosett says—"Even in the gross specimen the fact becomes manifest that the white substance of the cerebrum is built out of closely opposed laminae, a number of which are no thicker than the paper of this monograph." This process is repeated a number of times to ensure that dissection is as complete as possible. It is interesting to note that—"An examination of the cells by means of the Nissl and other cell stains showed a dislocation of the nucleus and other abnormalities, but nowhere a rupture."

The fiber tracts of a hemisphere so prepared were then dissected away along the lines of cleavage from within outwards, until only the thin layer of the intercortical pathways of the fissures remained. The surface left by this proceedure showed boat-like projections corresponding to the fissures of the cortical surface.

In order to make possible the proper orientation of the blocks into which the tissue must be cut for examination, plaster or metal casts were made of these preparations. The tissue in the region of the fissures was then cut into blocks of an appropriate size for examination of the tracts under the microscope. Notches were cut into the sides of these blocks, and holes punched in them at their edges, and these, together with the shape and position of the block, were reproduced on a drawing of a cast of the hemisphere.

One easily appreciates that in order to make possible the examination of as much as possible of the course of these pathways in microscopic preparations they must lie in a single plane. The fiber systems under consideration, however, have a naturally curved course, the curves being in most cases in more than one plane. Rosett has eliminated this difficulty by flattening his blocks. Since forceable flattening of these blocks of tissue would result in fracture of the cortex, and involvement in the damage of the subjacent intercortical fibres, incisions were made along the lines where fracture was likely to occur. The blocks were then flattened between two glass slides, imbedded in celloidin, sectioned in the plane of the surface, and stained by dipping the sections into boiling India ink, or by the Weigert-Pal method. As a result of this procedure, the paths of these fibers could be followed through a much greater part of their course than is possible by any other method, and their orientation in the fissure and in the hemisphere was accurately marked by the system of notches and holes.

In this manner Rosett has studied the intercortical systems of all of the main fissures of the human cerebrum, and in some cases of variants of the fissures. As a result he has identified a

basic pattern in every fissure which consists of two sets of fibers lying at right angles to one another, and passing obliquely across the fissure. Added to these fibers are other more or less irregular bands of fibers which vary with variations in the fissures in individual hemispheres. One hardly needs to state that the method employed is not calculated to give any information regarding the direction of the nerve impulse, that is, regarding the situations of the cells of the respective axones.

From this study Rosett has further concluded that the position of the intercortical fiber system is not determined by fissuration, as other authors have suggested, but rather that the fissures are the result of the presence in these places of the fiber tracts. His postulate is that when during development the neopallium tends to expand, the presence of the intercortical fiber bands opposes this expansion, which therefore takes place between them, so that sulci appear in the cortical surface at the positions occupied by these bands. It is thus seen that variations in complexity of the intercortical fiber systems are indicated on the surface of the hemisphere by variations in the complexity of fissuration.

We will omit detailed discussion of the fiber paths demonstrated in the various fissures, and deal briefly with only two of the deeper intercortical systems, which may prove of particular interest to the reader. These are:

(1) Pathways streaming between the temporo-occipital portion of the collateral fissure and the calcarine and parieto-occipital fissures. The clinician may be able to decide what part these connecting pathways between the visual and rhinal areas may play in the physiological association of their corresponding functions. The demonstration of this pathway is particularly interesting in view of the fact that Cushing and others have reported instances of associated visual and olfactory hallucinations.

(2) The Inferior Longitudinal Fasciculus. This tract has been a source of contention for many years. On the evidence of gross dissection the older anatomists had taken this to be a continuous fiber tract connecting the occipital, temporal and frontal poles. This schema has been repeatedly reproduced in text books, and this conception has become rooted in the minds of most clinicians. The later anatomists have had grave doubts in this matter. The use of the degeneration methods, and the work of Flechsig and others on myelination were responsible for the origin of the suspicion that this fasciculus was a thalamo-cortical radiation. Dissecting off the long straight visual fibers between the anterior curve in the temporal lobe and the calcarine fissure, Rosett found that the fibers of the fasiculus, which lies beneath them, were short and twisted. Removal of these fibers showed the boat-shaped sub-cortical laminae of the fissures. On this basis Rosett is inclined to think that the inferior longitudinal fasciculus is an intercortical system consisting of fibers of different length, the longest of which are much shorter than might be judged from the gross appearance of the bundle.

Although Dr. Rosett in his report draws no conclusions, pointing out that this work is barely begun, yet one cannot but feel that in the basic design of these intercortical fiber systems of the cerebrum, with their individual variations, no matter how small, there may be an approach to a biological basis for Psychology, and a morphological explanation for that elusive "Constitutional X" of the Psychiatrists.

PUCLIC HEALTH IN THE U.S.S.R.

O. M. SOLANDT, M.A., '36.

The public health problems faced by the Soviet Government after the revolution were of almost unbelievable magnitude. The Soviet Union occupies almost one sixth of the land surface of the globe, an area two and one half times as large as the United States. The population is estimated at 160 millions. Before the revolution there was very little public health work, except in the larger cities. Even those health organizations that did exist were completely wiped out by the revolution so that an entirely fresh start had to be made. The task of building up health services for this vast population was further complicated by the lack of trained men. There were relatively few doctors in Russia before the revolution. So many were killed or driven out during the Revolution that the shortage of doctors became acute.

The People's Commissariat of Health was formed in June, 1918, so that the health organization existing today represents only 17 years of progress. At the present time Public health work is divided into eight different departments. Each of the seven constituent republics in the Soviet Union has its own health commissariat which controls the activities of six of these departments in its district. The six departments so controlled are 1. The general medical department which operates hospitals and clinics, supervises anti-tuberculosis and anti-venereal work, psychiatric institutions, and, in general, the prevention and cure of disease in adults. 2. The mother and child department which cares for the health of children up to the age of three years and supervises pre-natal care and day nurseries. 3. A department for supervision of the health of children more than four years old. This department operates through medical services in kindergartens and schools. 4. The department of medical education which maintains schools for doctors and all other medical personnel. 5. Department of construction and finance. 6. Department of appointments.

The two departments which are directly under the central hygiene inspector in Moscow are the anti-epidemic department and the sanitary inspection department. This latter is probably the most important and most powerful branch of the public health service. It is further subdivided into four divisions for the inspection of schools, factories, municipal services and food. These inspectors are said to be armed with far greater power than are sanitary inspectors in any other country. However, we saw no evidence that this increase in power had led to any greater success in carrying out their duties.

One gains the impression that, although these vast plans have been formulated, the organization is, at present, far from complete. As in most things in the Soviet Union, development has been very uneven in different parts of the organization. As would be expected under a dictatorship of the proletariat, the urban industrial worker has received most of the privileges, so far. Even if one were qualified to present a general picture of public health work in Russia today, it would represent only a transitory stage in the development of an organization which is expanding with remarkable rapidity. For this reason a better picture of the quality of Soviet public health work can probably be obtained by a description of some of the more advanced parts of their work, which we were able to inspect personally.

The Soviet Union presents many unique opportunities for Public Health

work. Science is the new God of the Russians. Almost anything can be done in the name of science so that public opposition to health measures is greatly lessened. The completeness of government control also simplifies the task of public health administration. The regimentation of the adults in factories, collective farms and communal dwellings, and of the children in creches and schools makes general health supervision and education easier.

Housing

The problem of housing has been a very acute one because of the great shortage of buildings. Even at the present time the average worker has only one room; very few families, no matter how large, have more than three rooms. Nearly all the new dwellings are in the form of large blocks of flats. These are of two kinds, those designed for communal life and those designed for family life. The worker is free to choose which ever type of apartment he prefers. In the flats designed for communal life only the bedrooms are separate. The people eat in a common dining hall and enjoy their leisure in communal reading and game rooms. In the family type of flat a living room is included and the meals sent from the communal kitchen are served in the individual apartment. Both types of apartment are included in each block of workers' dwellings. The buildings surround a central playground where the children are cared for during the day by trained supervisors. In all the workers' dwellings, arangements are made for the wife to be free during the day. The communal kitchen and laundry and the supervision of the children make it possible for every mother to work in a factory or elsewhere during the day. This general employment of women is one of the most striking differences between our civilization and that of Russia. We first saw it on the boat from London to Leningrad where the crew included women as deck hands, radio operator, doctor, and engineer. In Leningrad nearly all the street cars are operated by women. The final proof of the equality of women was seen on the railway from Leningrad to Moscow where most of the navvies engaged in rebal-lasting the railway were women.

The construction of these communal dwellings is said to be supervised by sanitary inspectors who see that heating, lighting, water supply, sewage disposal and other factors necessary to health are adequate. The inspectors also maintain their interest in the buildings after they are occupied and see that they are kept clean, that the food is adequate and fresh and that all the regulations are adhered to. The punishment for lack of cleanliness is expulsion from the building.

While adequate regulations for the control of housing conditions are provided, it is difficult to determine how rigidly these are enforced. Some obvious defects in the inspection were encountered in the form of bed bugs in the leading hotels and myriads of flies everywhere.

Milk and Bread Supply

Nowhere did we see the possibilities of Soviet organization better displayed than in a milk pasteurizing plant which we visited in Leningrad. This plant, which is the largest of three in Leningrad, now employs 1,000 workers and bottles 500,000 litres of milk per day. When the plant is completed in 1936 this output will be doubled.

The milk is almost all received from collective farms. All the cows are tuberculin tested and are inspected every month. The milk is cooled at the farm and shipped to the bottling plant by motor truck, much of it in large, glass lined tanks. On arrival at the plant the milk is tested for sourness, cleanliness, bacterial count and butter fat content. A bonus is paid for cleanliness and high butter fat content. The pasteurizing equipment is all of the

standard A.P.V. type, and was made in England. The bottle washers, fillers and cappers are also of the latest type. The general construction of the plant is excellent. All the rooms where the milk is handled are tiled and are scrupulously clean.

The plant is operated strictly according to a plan which is revised annually in November. This plan sets forth the amount and quality of milk to be produced and the maximum cost allowable. If the quality is better, or the cost less than the plan calls for, the workers receive extra benefits and in some cases actual increases in pay. This year the plan calls for production at a cost of 30 roubles per metric ton. The minimum butter fat content is set at 3.2% and the maximum bacterial count at 30,000 per c.c. The low butter fat content is due to the poor quality of the available cows. The Kulaks, or farm owners, killed nearly all the good cattle in Russia before they were killed themselves. This has led to a great shortage of both beef and dairy cattle. Vigorous attempts are being made to improve the quality of the herds, but this will take some years.

The supervision of the workers seemed to be unusually good. Excellent locker rooms are provided for all the employees and each one must take a shower before beginning work. All workers wear white caps and gowns and even visitors must dress similarly. All the workers who actually handle the milk must wash their hands in chlorine water every hour. All employees receive a medical examination once a month.

Health legislation demands the pasteurization of all milk in the larger cities of the Union. Our visit to the Leningrad plant convinced us that the provisions for safeguarding the milk supply there were at least as good as those in our own cities. However, as in so many other things in Russia, the control of the milk supply seems to be incomplete because we frequently saw peasants selling milk on the streets, out of open cans, both in Leningrad and in Moscow.

One of the 17 modern bread factories in Leningrad was also visited. It was scrupulously clean and completely mechanized. Its principle interest lay in the fact that all the machinery was of Russian manufacture. The factory which we visited produced only the sour rye bread which is much more popular than white bread among the Russians. The only real criticism of this plant is that none of the bread is wrapped.

The distribution of bread and milk is interesting. Most of it is delivered directly from the plant to the communal kitchens or to the factories. The majority of the workers receive their bread and milk free, or at reduced prices at the factory where they work, or at their communal kitchen, if they live in one of the modern workers' districts There is no house to house delivery so that those who do not get their bread and milk at factory or kitchen have to go to special stores for them.

In the bread factory the minimum wage was 175 roubles per month. The employees, who are mostly women, work only four days out of every six and work for 8 hours each day. Working conditions in the milk plant are essentially similar, except that each worker gets a small share of any profit made during the year.

Hospitals

The larger cities of the Union are well supplied with hospitals and doctors. We were told that no one is left without medical care because he cannot pay. Medical care is not free and those who can pay do so, in proportion to their incomes. The one general hospital which we visited is probably a fair sample of the better city hospitals.

The Metchnikoff hospital lies on the outskirts of Leningrad. It was founded in 1909 but its most rapid expansion has taken place since the revolution.

It now consists of 45 buildings scattered about a large park. It contains 2,400 beds and admits every sort of patient except those suffering from infectious diseases. The parts of the hospital visited seemed very clean and well kept. The grounds and gardens are unusually fine and are partly tended by convalescents and tuberculous patients who are able to do light work.

Associated with the hospital is a medical school with about 1,000 students. One of the interesting features of the medical school is the students' common room, in which are exhibited for the inspiration of the students, the heart and brain of the former chief of the school.

This hospital receives its patients from ten out-patient clinics which are scattered throughout the city. In addition, it maintains several travelling clinics which visit factories. The hospital is at present carrying out an intensive campaign for the early diagnosis of cancer, both by means of these clinics and by educational work among the factory workers.

Care of Children

The wholesale employment of women in industry has made necessary extensive arrangements for the care of infants and young children while their mothers are at work. Most of the infants are looked after in creches where trained nurses feed and care for them. These creches are usually operated in connection with the factory in which the mother works so that she can conveniently feed the child while it is still being nursed. The creches in Leningrad now have accommodation for 12,000 infants. Because of the great shortage of workers everything possible is done to encourage people to have children. A woman is allowed two months holiday before the birth of a child and two months afterwards, with full pay. She is also given time off to feed the child as long as it is being nursed. The more prosperous factories give the mother a complete outfit of clothing for the child. People with large families also get special consideration in the form of free milk, bread, clothing, etc.

The older children are cared for in the nursery which occupies the central court of each of the workers' settlements. After the children are old enough to go to school, their life is much the same as here, except that they receive their noon meal at the school because their mothers are away working.

The Mother and Child Institute, in Leningrad, is a most unusual institution. In it are combined a general hospital for children, an obstetrical and gynecological service, an orphange, an experimental laboratory for the study of conditioned reflexes in both animals and children and a medical school for paediatricians. The Soviet regard paediatrics as one of the most important and most difficult branches of medicine. The paediatrician begins to specialize very early in his course and spends six years instead of five in obtaining his degree.

The laboratory for the study of children is probably the only one of its kind in the world. The children studied are all orphans or unwanted children. They are admitted to the laboratory in groups of eight at the age of three weeks. They live there until they are three years old, when they are sent to foster homes. During this period they are used for experiments of all sorts, which include all aspects of feeding, habit formation, exercise, etc. In addition the learning process and the development of conditioned reflexes are studied. The experiments on the children are supplemented by experiments upon dogs, carried out in the same laboratory.

All children admitted to this hospital receive diphtheria toxoid and vaccination against smallpox. Some of the children are now being immunized against scarlet fever also. This was the only example of the measures being taken for the control of infectious

diseases that we actually saw, but presumably much more is being done.

Communal Feeding

The widespread employment of women in industry has made necessary provision for communal feeding of workers and their families. At the present time in the more densely populated industrial districts, over 70% of the population are being fed from community kitchens. Sixteen million people are fed from factory kitchens and five million more eat in communal dining rooms in rest homes, sanitaria and nurseries. In some of the larger factories, special dining rooms are provided for those requiring special diets. This tremendous amount of communal feeding offers an unprecedented opportunity for the application of modern knowledge of nutrition on a scale not possible in any other country.

Holidays

An important part of the Soviet plan for safeguarding the health of the industrial worker is the provision of adequate holidays. Every factory worker receives from two to four, or even six weeks holidays, with pay, every summer. The length of the holiday depends upon the health and ability of the workman and upon the success of the factory in which he works. Many of the better factories have their own summer resorts to which the workers are sent free of charge. Many of the older children go to special children's camps for a month. Sickly children are given two months holidays at special camps under medical supervision.

These scattered glimpses of some aspects of public health work in the Soviet Union will serve to show that the best work being done there is of a very good quality. It is difficult to ascertain just how widespread the public health work is. However, it is certain that only a very small percentage of the population is adequately served at present. The industrial worker in a good factory in a large city, seems to enjoy most of the benefits of modern health measures. We are told that the larger collective farms have similar advantages. Apart from these groups, health services do not seem to be at all complete. The Soviet government plans to give the most complete health service to all its citizens even in the most outlying districts. Whether this ideal will ever be reached, time alone will tell.

MEDICAL AT-HOME.

Royal York Hotel, Feb. 7, 1936

The Medical At-Home this year is being anticipated as one of the big events of Toronto's social season. The committee expects to secure an internationally known orchestra from the United States for the evening, so one of the finest parties in many years is expected.

Be sure and secure your tickets and reservations early.

BOOK REVIEW

Clinical Science, by Sir Thomas Lewis, Physician in chargt of Department of Clinical Research, University College Hospital, London. 189 pages. Shaw and Sons, London, 1934.

This new book by Sir Thomas Lewis, one of the greatest living medical teachers and research workers, should be read by every student in the clinical years in medicine. In it the author attempts to outline the scope and methods of that realm of investigation which he refers to as 'clinical science'. The outline is illustrated by many references to the author's own work along various lines, including such subjects as auricular fibrillation and flutter, arteriovenous anastomoses, capillary contraction and capillary pulsation, the triple responce of skin to injury, axone reflexes in man, muscular pain in intermittent claudication, anginal pain, subacute bacterial endocarditis, "Raynaud's Disease", erythralgia, etc. A tremendous amount of valuable information on all these subjects is presented in very readable form. However, the chief value of the book to the student is not to be found in this information, but in the description of the reasoning that guided the investigations which supplied the information. Every student should have some idea of the methods of science if he is to take advantage of the opportunities for observation and experiment that will arise during his practise. In this book, Sir Thomas clearly sets forth the various steps that were taken in solving the problems which were attacked. He shows clearly that much can still be learned by an intelligent study of the common manifestations of disease as seen in human patients. When this study is combined, where necessary, with animal experimentation, results of great importance can be obtained. Sir Thomas also shows that a not inconsiderable amount of present day teaching in clinical medicine is without foundation, and that many of these erroneous teachings can be proven to be false by relatively simple observations. In discussing erythromelalgia he says that, "For 60 years the term 'erythromelalgia' with all that it connoted has stood almost if not quite unchanged; it has acted as an anaesthetic rendering medicine unresponsive to the idea that there is no such special malady, and incurious of the meaning of a number of prenomena often to be observed in patients; phenomena which at once yield up much of their meaning if probed by simple and commonplace enquiry conducted in an atmosphere free from the prejudice of nomenclature."

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